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ONTARIO

Department of Education

# Courses of Study

Grades IX, X and XI

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GENERAL SHOP

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Issued by Authority of  
The Minister of Education

**COURSES OF STUDY**  
for  
**Collegiate Institutes, High, Vocational, and Continuation  
Schools, and Public and Separate Schools**  
in  
**Grades IX, X and XI**

**GENERAL SHOP**

**DRAFTING**

**APPLIED ELECTRICITY**

**FARM MECHANICS**

**FORGE AND VISE WORK**

**MACHINE SHOP PRACTICE**

**ORNAMENTAL METAL WORK**

**MOTOR MECHANICS**

**SHEET METAL WORK**

**WOODWORK**

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# COURSES OF STUDY

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## GENERAL SHOP

The General Shop Course in Grade IX is intended to offer subject matter of an exploratory nature which is closely related to the practices of the trades and the industries. Pupils enrolled in this course are given an opportunity to discover their aptitude for shop work with a view to determining the character of their future educational programmes. Where shop work is elected in Grade X, provision is made for a more advanced study of general shop practice.

### OUTLINE OF COURSE

Drafting is obligatory and any three of the following may be selected: applied electricity, farm mechanics, forge and vise work, machine shop practice, ornamental metal work, motor mechanics, sheet metal work, woodwork.

**NOTE:** Any other practical subject approved by the Minister may be substituted for one of the foregoing optional subjects.

### ADAPTATION

As the suggested courses of study must meet the requirements of shop work in different types of schools, it is necessary to interpret these suggestions according to the requirements of the various schools.

### SUGGESTIONS FOR THE USE OF THE COURSES

Outlines for the various shop courses are provided herein. The content of any course may be rearranged to suit the plan of teaching and should be detailed to form a complete course of study.

In the presentation of shop instruction the project is the usual medium through which operations common to various trades are introduced. Projects selected should cover the topics of the course and should recognize the interests and abilities of the pupils. A variety of projects for any course is essential.

The plan of the general shop necessitates the provision of instruction in a number of varied activities simultaneously. Shop libraries, illustrative materials, and other lesson aids carefully organized to direct pupil effort will be found of valuable assistance in the presentation of instruction, and in the general administration of the shop.

Dangerous conditions with respect to the health and safety of pupils in the school shop must be avoided. Machines must be properly guarded and machines and tools must be maintained in good operating condition. Pupils should always receive proper instruction before being permitted to operate a machine.

Tools and other equipment should be properly stored in cabinets provided for the purpose and made readily accessible to the pupils as required.

Each job or operation performed by the student should be appraised and recorded promptly by the instructor.

An inventory of tools and equipment should be kept up to date.



# GENERAL SHOP COURSE OF STUDY

for

Collegiate Institutes, High, Vocational, and Continuation  
Schools, and Public and Separate Schools

in

## DRAFTING—GRADE IX

### 1. Lines:

- (a) Outlines—use of simple instruments in drawing lines to given lengths in the lay-out of rectangles and regular figures which represent the working drawing views of simple objects.
- (b) Dimension lines—weight of dimension lines, purpose and proper placing on simple working drawings.
- (c) Hidden outlines—the introduction of the broken line to represent hidden edges or surfaces.
- (d) Centre line—symbol and use.

### 2. Lettering: Plain stroke freehand lettering to be introduced incidentally as required, general requirement of good lettering.

### 3. Working Drawings:

- (a) Working drawings—(two or three views) of simple regular objects arranged in proper sequence, using (1) scale of 12 inches = 1 foot, and (2) scale of 3 inches = 1 foot.
- (b) Working drawings of angular objects (using straight lines) such as wedges and tapered pieces.
- (c) Working drawings of circular or semi-circular objects requiring methods of locating and dimensioning holes.
- (d) Working drawings of objects of which sectional views are required; method of representing materials in section.

### 4. Geometrical constructions—reference sheets showing standard geometrical construction should be available for pupils' use. Instruction on this topic should be given incidentally as required.

**NOTE :** In schools serving rural areas the projects selected for the drafting course should be made especially applicable to the home and the farm. The blue print reading part of the course should include a study of complete drawings of simple, useful farm or home equipment to assist the pupil in picturing the object, locating dimensions, and estimating cost of construction.

## APPLIED ELECTRICITY—GRADE IX

### 1. Circuits:

- (a) A complete circuit installation consisting of: supply of current (dry cells or 6-Volt battery); conductors, switch or push button; and load (sockets and lights, or bell or buzzer).

- (b) Signal circuits—bell, annunciator, and alarm circuits.
- (c) Radio antennae circuit installation—action of lightning rods and necessity for good ground connections.
- (d) Commercial wiring circuit—one or more circuits in standard knob-and-tube construction, comprising branch circuit box source, fuses, switch and parallel load; reference to Hydro-Electric rules covering this circuit.

2. Joints, soldering, and weatherproofing:

- (a) Making simple joints as required; purpose in making a joint.
- (b) Soldering—operation and care of blow torch (if used); preparation of soldering bit and use of flux in soldering.
- (c) Weatherproofing—taping and use of compound.

3. Magnetism and Electro-magnetism:

- (a) Magnetic field about a permanent magnet examined by use of filings or small compasses.
- (b) Making an electro-magnet, plotting magnetic field, and studying polarity.
- (c) Examination of field of force about a single wire carrying a current of electricity; development of the “right hand rule.”

4. Study of action of annunciator and of electric bell or buzzer.

5. Conductors and insulators—experimental study of a few common metals, non-metals, and solutions as a basis for general classification into conductors and non-conductors. Examination and discussion of a few commercial insulators.

6. Circuit protection—the heating effect of the electric current; the simple fuse as a device for protecting circuits and equipment; types of fuses; carrying capacity of standard wires and cables used in the home.

7. Circuit testing—construction and use of a test-lamp for trouble shooting.

## FARM MECHANICS—GRADE IX

1. Paints and finishes—paints for wood, iron, and concrete; preparation of surfaces; home mixed and ready mixed paints; white washes; the care of brushes.

2. Rope work—kinds and grades of rope; uses of rope on the farm; care of rope; common knots and their uses; whipping a rope end; crowning and tucking a rope end; making a short splice, long splice, and eye splice.

3. Belt lacing—leather and fabric belts; care of belts; tools required in belt lacing; making of samples of single lacing and double lacing, using cardboard and cord.



4. Harness repairing—importance of keeping harness in good condition by cleaning, oiling, and repairing at least once a year; tools and materials needed; making a waxed thread and practice in stitching splices; attaching snaps, buckles, etc.
5. Glazing—tools; preparation of putty; value of priming coat on sash; methods of cutting glass; practice in putting glass in new sash or in replacing glass in a broken window.
6. Pipe fitting:
  - (a) Materials—black and galvanized iron;
  - (b) Operations—cutting, reaming, threading, sealing; use of couplings, elbows, ties, reducers; measuring runs and making layouts.

## **FORGE AND VISE WORK—GRADE IX**

1. Forge and vise tools and equipment:

Trade description of such tools and equipment as may be available for the teaching of this course.
2. The forge fire:

Selection of fuels, arrangement of fuels and proper maintenance of fire; temperatures required for metal working.
3. Forge operations:

Heating, cutting, bending, drawing, upsetting, forging a flat, and punching.
4. Vise work operations:
  - (a) Laying out, cutting with hack saw, filing, drilling (hand drill), countersinking, riveting, finishing;
  - (b) Tapping and threading—tapping a through hole; relation of tap and drill sizes; precautions, and use of proper cutting oil; threading with a die.

## **MACHINE SHOP PRACTICE—GRADE IX**

1. Hand tools and bench work:
  - (a) Trade description of such tools and equipment required for this course as soft and hard hammers, chisel, punch, file, hack saw, taps and dies, and vise;
  - (b) Operations such as sawing, use of hammer and chisel, filing, riveting, use of steel letters in marking, threading (taps and dies).
2. Layout work:
  - (a) Coating of metal surfaces (copper sulphate, chalk) to facilitate layout;

- (b) Use of steel rule, dividers, scribe, hermaphrodite caliper and punch in laying out work from blueprints or drawings;
- (c) Centering work for drilling.

### 3. Machine tools and operations:

- (a) Lathe—names of main parts; setting up work in machine, side facing, rough turning, shoulder turning, finish turning to size and polishing.
- (b) Drill press—names of main parts; operation and maintenance; preparation of work for drilling (including marking with centre punch); use of vise for mounting work; selection and mounting of drills; use of cooling and cutting compounds.
- (c) Grinder—safety precautions and use of goggles; rough grinding to remove hard skin of material; rough grinding to bring material to size.

## ORNAMENTAL METAL WORK—GRADE IX

1. Materials—strap and bar iron, copper, brass.
2. Properties of materials—a study should be made, incidental to the making of the project, of the characteristic properties of the metals, their stock sizes, and gauges.
3. Operations:
  - (a) Laying out.
  - (b) Cutting, bending, twisting, drilling and countersinking, riveting.
  - (c) Transferring patterns, hammering for raising and sinking, annealing, matting, piercing, etching, polishing, cleaning.
  - (d) Soldering—tinning the iron, applying flux, holding iron in proper position for heat flow.
  - (e) Heat treating for resistance to rust; painting, lacquering.

NOTE: The projects selected should provide for the introduction of a good variety of typical operations in ornamental metal work.

## MOTOR MECHANICS—GRADE IX

### 1. Chassis:

- (a) Parts—a brief examination and study to obtain the general purpose, and location of the following parts in tracing the path of power: engine, clutch, transmission, differential.
- (b) Specifications—meaning of wheel base, steering ratio, types of spring suspension.

### 2. Engine:

- (a) Parts—identify, dismantle, and assemble parts pertaining to a sectioned one-cylinder engine operating on the four-stroke cycle principle;



- (b) Operation—events in the four-stroke cycle including reference to combustion mixtures and dangers of carbon monoxide in exhaust gases.

3. Unit parts:

- (a) Clutch—examination of a single-plate clutch to observe the function of the foot pedal in the operation of the clutch parts.
- (b) Gear box—examination of simple gear box to discover general arrangement of parts for various gear shift positions and speed ratio of crank shaft to propellor shaft.
- (c) Differential—experimental determination of the main functions of a differential unit.
- (d) Steering—examination of one type.
- (e) Brakes—shoes, drum, and linkages applied to one wheel.
- (f) Ignition—a simple demonstration ignition unit planned to control one cylinder which can be operated by pupils to observe (i) primary and secondary circuits and (ii) spark produced by opening distributor contacts.

## SHEET METAL WORK—GRADE IX

1. Materials:

- (a) Galvanized sheet iron and tinned iron—method of manufacture, common uses, advantages, stock sizes, and gauges.
- (b) Solders—common solder, components, reasons for different alloys.
- (c) Fluxes—purpose, various common fluxes and their suitability.

2. Operations and tools:

- (a) Laying out—use of measuring and marking tools; making seam allowances.
- (b) Cutting—use of snips.
- (c) Folding and forming—use of mallet, hammer, stakes, adjustable bar folder, bending brake, grooving tools in the construction of simple rectangular objects.
- (d) Soldering:
  - (i) Soldering iron—oxidation, tinning, design for transference of heat.
  - (ii) Soldering—heating the iron, correct position of iron, fusing solder, use of flux.

3. Sheet metal finishes—methods of preparing various sheet metals to take protective or decorative coatings.

## WOODWORKING—GRADE IX

Where offered, the Manual Training in Grades VII and VIII should be recognized and used in Grade IX as a basis for a more intensive development of skills in hand and machine operations. The content of this course may be reduced to suit the needs of the pupils and the equipment available.



In schools serving rural areas the projects selected for this course should be especially useful in or about the home and on the farm.

Course:

1. Materials:

- (a) Lumber—such woods as pine, basswood, whitewood, gumwood, birch, or oak are generally found to be suitable; recognition of these and other common woods; processing of lumber; units of measurement and stock sizes.
- (b) Sundries:
  - (i) Glue—kinds, sources, preparation for use.
  - (ii) Hardware—types and specification for common nails, wood screws, and other hardware in common use.
  - (iii) Finishing materials—characteristic properties; uses and limitations of stain, shellac, varnish, and paints.

2. Hand tool operations:

- (a) Laying-out—selection of pieces to avoid waste and use of marking tools.
- (b) Sawing—cross-cut and rip sawing.
- (c) Planing—surfaces, edges, ends, at an angle to the grain.
- (d) Squaring—steps in truing to size; use of square and back saw.
- (e) Chamfering—planing and chiselling a chamfer; stop-chamfering.
- (f) Chiselling—paring, chiselling curves, perpendicular chiselling, use of mallet.
- (g) Shaping—use of coping saw, bow saw; use of spokeshave and file.
- (h) Boring—use of various types of bits and depth gauge; boring for screws and dowels.
- (i) Fastening—selection and use of nails, screws, glue; clamping.
- (j) Sanding—uses of various grades of sand paper and steel wool.
- (k) Finishing—staining, shellacking, varnishing and polishing; care of brushes; proper storage of materials, fire hazards.

NOTE: Pupils should be instructed in the general trade specifications for all hand and machine tools, and materials within the scope of this course.

3. Machine tools and operations:

- (a) Variety saw—cross-cutting and ripping, cutting rabbets and dados.
- (b) Band saw—sawing simple curves.
- (c) Jig-saw—sawing simple scrolls.
- (d) Jointer—jointing edges.
- (e) Lathe—rough and finish turning to size, shoulder and taper turning, turning simple beads and curves; face plate turning; use of calipers and templates.
- (f) Grinder—sharpening chisels and plane irons; whetting.

**GENERAL SHOP COURSE OF STUDY**  
**for**  
**Grade X**  
**in**  
**Collegiate Institutes, High, and Continuation Schools,**  
**and Public and Separate Schools**

**DRAFTING**

Course:

1. Detail and assembly drawings: objects composed of several parts, such as a nail box or simple table.
2. Machine drawings:
  - (a) Enlarged profiles of simple threads to illustrate their characteristics.
  - (b) Standard practice for indicating threaded ends and tapped holes.
  - (c) Detail and assembly drawings of simple mechanical objects or tools involving threads, tapped holes, counter-sunk holes, and sections.
3. Orthographic projection: The introduction of simple problems in orthographic projection.
4. Development of surfaces:
  - (a) Rectangular objects.
  - (b) Cylindrical objects—right cylinder and oblique cut cylinder (parallel line development).
  - (c) Conical objects (radial line development).

NOTE: Standard allowances are required for laps and seams.

**APPLIED ELECTRICITY—GRADE X**

1. Circuits:
  - (a) A circuit with a fixed load in which dry cells as a source of current may be added in series one at a time, to observe and record the general effect of increased voltage; repetition of foregoing circuit, except that the dry cells are placed in parallel.
  - (b) A circuit in which there is a constant supply voltage, and load units are added one at a time to observe and record effect of adding (i) series load and (ii) parallel load.
  - (c) Signal circuits—bell controlled by two or more different buttons; two or more bells controlled by one button; bells in series; return call system; ground return system; other elementary circuits within the range of this course.



- (d) Lighting circuits—branch lighting circuits in both knob-and-tube and non-metallic sheathing construction such as (i) parallel operation, (ii) two lights controlled by a three-way switch, (iii) one light controlled by two three-way switches.
  - (e) Service installation—30 amperes.
  - (f) Automobile circuits—lighting, ignition, starter, and generator circuits.
2. Electrical units—sufficient experimental acquaintance with elementary circuits to gain the concepts of volts, amperes, ohms, and watts. The use of meters is essential.
  3. Magnetism and induced currents:
    - (a) Plot the field of force about two or more commercial type permanent magnets.
    - (b) Discover the laws relating to the direction and relative value of an induced current.
  4. Instruments—parts, theory of operation and location in circuit for D. C. ammeters, voltmeters, and wattmeters.
  5. Cost of electrical energy—determining cost of operation of common household heating appliances from name plate readings and verifying experimentally the watts consumed for at least one appliance; checking experimentally the wattmeter x time against the kilowatt-hour meter; reading the kilowatt-hour meter and computing the cost of electrical energy for an observed load.

## FARM MECHANICS—GRADE X

1. Tool sharpening—use of grindstone, emery wheel, and oil stone in sharpening flat, keen edge-tools such as plane irons and chisels; grinding cold chisels; saw jointing, setting, and filing.
2. Rope work and tackle blocks:
 

The Grade IX work reviewed and extended to include:

  - (a) Knots—square, stevedore, surgeon's, binder, slip, bowline, double bowline, weaver's, fisherman's eye, bag, strap, sheep shank, half hitch, timber hitch, clevis hitch, scaffold hitch, blackwall hitch.
  - (b) Splices—eye, loop, short, long.
  - (c) Single fixed pulley, single movable, one fixed and one movable, double block and single block, two double blocks.
3. Belt lacing—practice in lacing of leather and fabric belts.
4. General repair work—repair of farm implements and machinery involving operations in wood and metal, and painting. A careful selection should be made of worth-while jobs for repair work to ensure instruction of value to the pupil.

5. Concrete work: An introduction to concrete work.
  - (a) Properties of natural and portland cement;
  - (b) Aggregates (sand, gravel, crushed stone, cinders);
  - (c) Mixing—proportions, measuring, mixing;
  - (d) Testing.

## FORGE AND VISE WORK—GRADE X

1. Forge operations:
  - (a) Cutting, bending, drawing, upsetting, forging flats, punching.
  - (b) Welding.
  - (c) Heat treating:
    - (i) Workability of various metals.
    - (ii) Distinguishing tests for metals.
    - (iii) Simple hardening of steel—heating, oil quenching, water quenching, testing.
    - (iv) Tempering—preparation of steel, recognition of colour scale, quenching, testing.
    - (v) Case hardening.

NOTE: An elementary study of the theory of heat treatment should be made incidental to the performance of selected operations within the ability of the student. Precautions should be taken to avoid dangerous cyanide fumes in case-hardening operations.

2. Vise work operations:
  - (a) Laying out, cutting with chisel and hack saw, bending, twisting, drilling, countersinking, riveting, filing, finishing with abrasives.
  - (b) Tapping and threading:
    - (i) Tap drill sizes; taper, plug, and bottoming taps; precautions in use of taps; tapping a blind hole.
    - (ii) Threading with a die, adjustment of die, national standard threads, pipe threads and pipe sizes.

## MACHINE SHOP PRACTICE—GRADE X

1. Hand tools and bench work:
  - (a) Trade description of tools and equipment required for this course, such as hammers, chisels, punches, files, hack saws and vise;
  - (b) Operations such as use of hammer and chisel, filing, riveting, threading (taps and dies).
2. Layout work:
  - (a) Preparing metal surfaces to facilitate layout;
  - (b) Use of common tools in laying out work from drawings.
3. Machine tools and operations:
  - (a) Lathe—various turning operations between centres and on work mounted in chuck; knurling, cutting tapers, threading.



- (b) Drill press—preparation of work for drilling, use of vise and V-block for mounting work, selection and mounting of drills, use of cooling and cutting compounds.
- (c) Grinder—rough grinding, grinding to size, tool grinding.

## ORNAMENTAL METAL WORK—GRADE X

### 1. Materials:

- (a) Such metals as strap and bar iron, copper, brass, aluminum, Britannia metal.
- (b) Solders—composition of soft and hard solders, study of fluxes for various types of work.

### 2. Operations:

- (a) Laying out.
- (b) Cutting, bending, twisting, drilling and countersinking, filing, riveting.
- (c) Transferring patterns, hammering for raising and sinking, annealing, matting, piercing, etching, planishing, polishing, cleaning.
- (d) Making of such joints as are required in the project—butt, lap, countersunk, riveted, grooved and double grooved, scarf or wedge.
- (e) Soldering—hard and soft soldering.
- (f) Heat treating for resistance to rust; painting, lacquering.
- (g) Spinning—metal spinning in the lathe.

NOTE: Projects which introduce more advanced and intricate operations should be selected for this course.

## MOTOR MECHANICS—GRADE X

### 1. The Multi-cylinder Engine:

- (a) Pistons—study of relative position of pistons in various cylinders, relation of crank to stroke, purpose of flywheel; detail study of piston assembly including rings, pins, connecting rod and bearings.
- (b) Valves—study and adjustment of one type of valve arrangement.
- (c) Timing—an elementary study of ignition timing and valve timing applied to a simple engine.
- (d) Lubrication system—trace oil passage through the lubrication system for the engine, examine and operate an oil pump unit, study selection of motor oils for various temperatures and conditions.
- (e) Cooling system—trace water passage through the cooling system for the engine, examine parts such as water pump, thermostats, and radiator; anti-freeze solutions.
- (f) Fuel system—properties of gasoline, examine and test a fuel pump, trace fuel lines, examine a simple carburettor, adjust carburettor, clean lines and strainers.

### 2. Other chassis parts:

A more detailed study of the following parts: clutch, gear-box, drive shaft, differential, brake, rear-axle assembly, front-axle assembly. The parts referred to should be examined, taken down, and re-assembled.

3. General Care of the Automobile—washing, cleaning, polishing, tightening, removing squeaks, general lubrication.

## SHEET METAL WORK—GRADE X

1. Hand operations:

The hand operations as outlined in the Grade IX course applied to rectangular and circular objects.

2. Machine tools and operations:

- (a) Names of main parts, proper use, adjustments and precautions to be observed for the following machines: foot squaring shears; brake; bar folder; slip roll former; wiring, burring and turning machine; beader and groover.
- (b) Operations including folding, locking, rolling, grooving, wiring, beading, turning, and burring.

## WOODWORKING—GRADE X

In schools serving rural areas, the projects selected for this course should be especially useful in or about the home or on the farm.

1. Hand tool operations:

Where hand-tool operations serve best the construction of the project or part thereof, or are essential to the making of the project owing to lack of machine equipment, a higher degree of manipulative skill is expected.

Operations: laying out, sawing, planing, squaring and truing to size, chamfering, chiselling, shaping, boring, fastening, sanding and finishing.

2. Machine tools and operations:

- (a) Variety saw—cross-cutting and ripping, cutting rabbets and dados.
- (b) Band saw—sawing curves.
- (c) Jig saw—sawing scrolls.
- (d) Jointer—jointing edges and faces.
- (e) Lathe—rough and finish turning to size, shoulder and taper turning, turning more elaborate curves, larger face-plate work.

3. Home mechanics:

The fundamental principles of woodworking applied to hanging doors, fitting locks, fitting window sash, glazing windows, re-finishing furniture, and other similar jobs about the home.

4. Finishing—staining, filling and varnishing, shellacking, rubbing, use of paints and enamels.



# GENERAL SHOP COURSE OF STUDY

## Grade XI

### DRAFTING—GRADE XI

1. Machine Drawing—problems involving placement and projection of views, auxiliary views, sections and dimensioning; the use of several different scales; detail and assembly drawings of familiar objects including machine parts.
2. Building Construction:
  - (a) Problems involving the use of the more commonly used symbols indicating details of building construction, electrical work, plumbing and drain plans.
  - (b) Simple floor plans of structures such as a cottage or a farm building, using architectural conventions.
  - (c) Knowledge of the properties and purposes of the building materials commonly employed in the community. Simple sketching and layout plans indicating the use of these materials.
3. Landscape Drawing—map making to scale, such as a layout for a subdivision, park, farm or garden.

### APPLIED ELECTRICITY—GRADE XI

1. Circuits:
  - (a) Measurement of voltage drop in light, heat or power circuits.
  - (b) A circuit in which there is a constant supply voltage and combinations of various load units connected in series-parallel, parallel-series or both—in order to record current flow through each path, and combined resistance of grouping.
  - (c) Loss of useful energy due to heating of conductors. Necessity of adequate size conductors.
  - (d) More advanced practical wiring, including installation of branch circuits in buildings for light, heat and power, using non-metallic and metallic cable wiring. Lighting circuits controlled by one-, two-, three- and four-point switches. Heating circuits used in electric ranges, hot water heaters and electric grates.
  - (e) Examination of a service installation.
2. Measuring instruments—more extensive study of action, construction and use of D.C. voltmeters and ammeters.
3. Magnetic units—an experimental study of electro-magnets to show the effect of strength of current, number of turns, and material in core, on magnetic circuits.
4. Magnetism and induced currents—production and nature of induced currents, including the elementary laws of induction relating to direction of induced pressure.

5. Motors and generators—study of D.C. generators and motors (series, shunt and compound); stripping a small D.C. armature (model); making out data sheet and rewinding, using necessary tests as winding proceeds.

## **FARM MECHANICS—GRADE XI**

1. Lubrication—grades and proper use of lubricants for different types of farm machinery, such as engines, electric motors, windmills, pumps and binders.
2. Tool sharpening—use of grindstone, emery wheel, files and finishing stones in sharpening tools and implement cutters, such as axes, hoes, cultivator points, binder and mower knives; jointing, setting and filing of hand and circular saws.
3. Rope work and tackle blocks:
  - (a) A more extensive knowledge of strength and quality of rope required for a variety of farm purposes.
  - (b) Splices—short and long in heavy rope.
  - (c) Blocks containing one, two, three and four pulleys.
4. Belts and belt splicing:
  - (a) Various types of belts, such as leather, fabric and vee.
  - (b) Practice in splicing by gluing, lacing, and using rawhide and metal fasteners.
5. Farm repair work—repair of farm implements involving worthwhile operations in wood and metal such as replacing guards on cutter bars, sections in blades, adjusting binder knotters, replacing wooden slats and leather straps on binder canvases; grades of paint for farm buildings and equipment; simple harness repair jobs.
6. Concrete work:
  - (a) Proportions and methods of mixing.
  - (b) Types of mixing machines.
  - (c) Construction of simple wood and metal forms.
  - (d) Use and variety of reinforcing material.
  - (e) Selecting and testing aggregates.
7. Pipe work:
  - (a) Cutting, threading, fitting, and assembling pipe.
  - (b) Installation and maintenance of valves and fittings.

## **FORGE AND VISE WORK—GRADE XI**

1. Forge operations:
  - (a) Cutting, bending, drawing, upsetting, forging flats, punching, twisting; making and using templates for testing curves and lengths of duplicate parts.
  - (b) Brazing, welding, fastening with clips.



(c) Heat treating—hardening, tempering, testing, case hardening.

2. Vise work operations:

- (a) Bending with the use of forms, twisting, drilling, countersinking, riveting, filing; finishing with abrasives, flat black and bronze paint, enamel, lacquer, and hammer; raising of flat surfaces.
- (b) Cutting, bending, and drilling tube material, and finishing same.
- (c) Tapping and threading:
  - (i) Tapping blind and through holes.
  - (ii) Threading with a die, National Standard and pipe threads.

## **MACHINE SHOP PRACTICE—GRADE XI**

1. Hand tools and bench work—more difficult operations in riveting, threading (taps and dies), and filing to size.
2. Layout work and inspection checking—more advanced layouts involving use of surface plate, surface gauge, thread gauge and micrometer gauge.
3. Machine tools and operations:
  - (a) Lathe—extension of work in turning operations between centres and on work mounted in chuck; right hand standard vee thread cutting; external taper turning; drilling and boring; repair and upkeep of belting.
  - (b) Drill press—drilling to layout including depth; use of countersink; spot facing; drawing holes to desired location; drilling for tapping; clamping of odd shape work.
  - (c) Grinder—grinding of lathe tool bits and drills; dressing of abrasive wheel; properties, selection and use of abrasives.
4. Fasteners—special uses and practice in the use of rivets, machine screws, cap screws, stud bolts, set screws, taper pins, keys.
5. Calculations—application of mathematical principles to gear ratios, speeds and feeds, tapers and threads.

## **ORNAMENTAL METAL WORK—GRADE XI**

1. Materials:

- (a) Pipe, rod, sheet, and ingot forms of softer metals such as brass, copper, aluminium, lead; strap, bar and sheet iron, both black and galvanized, and sheet alloys of steel which may be workable with ordinary tools; angle iron, aluminium and brass; screening of copper, brass, iron.
- (b) Solders and brazing materials for the various metals used.

2. Operations:

- (a) Laying out drawings and patterns and transferring from measurements.

- (b) Extension of work previously done in cutting, bending, twisting, drilling, filing, and riveting.
- (c) Fastening with bolts, nuts, and machine screws, and tapping holes for same.
- (d) Hammering for raising and sinking, to include curving of edges and fluting of sides, annealing, pickling, matting, lining, piercing, punching, punching for tapping, etching, planishing, polishing, cleaning and buffing.
- (e) Making of the various joints.
- (f) Soldering and brazing.
- (g) Use of a variety of finishes, to include painting, lacquering, heat and chemical colouring.
- (h) Metal spinning in the lathe.

## **MOTOR MECHANICS—GRADE XI**

1. The automobile engine:
  - (a) Removing and replacing gaskets.
  - (b) Piston displacement and compression ratio.
  - (c) Removing and replacing pistons and connecting rod assemblies.
  - (d) Checking cylinder condition for wear.
  - (e) Adjusting valves.
2. The automotive electric system:
  - (a) The battery—its care and service operations.
  - (b) The starter and generator—general principles and simple service adjustments.
  - (c) The lighting system—kinds of cables and terminals, types of lamp bulbs, adjustment of head lamps.
3. Ignition system—simple adjustments, such as cleaning distributor, adjusting spark plugs, servicing connecting wires.
4. Carburetion:
  - (a) Principle and construction of the single-throat carburettor.
  - (b) Cleaning and simple adjustments.
5. Transmission system:
  - (a) Dismantling and assembling a clutch.
  - (b) Study of the transmission unit—tracing path of power and determining speed ratio for each shift.
  - (c) Examination of a rear axle unit.
6. The steering gear and front wheels—examination of a typical steering and linkage assembly.
7. Brakes:
  - (a) Examination of mechanical and hydraulic braking systems.
  - (b) Adjusting two types of brake shoes.
8. Traffic regulations—a study of important rules and regulations of the Ontario Traffic Act.



## SHEET METAL WORK—GRADE XI

### 1. Hand tool operations:

The hand tool operations as outlined in the Grade IX course applied to more difficult problems requiring parallel and radial development, and to rectangular shapes with splayed sides; greater facility in the use of the soldering iron; sweat soldering and riveting.

### 2. Machine tool operations:

More extended use of all tools and machines; operations of Grade X continued; the setting and adjustment of machine tools to allow for gauge, kind of metal and for wired edges.

### 3. Problems:

Practical application in such objects as two-piece elbows, funnels, pails, cups, flaring pans, jardinières, window boxes, and scoops.

## WOODWORK—GRADE XI

### 1. Materials:

- (a) Lumber—the common Canadian woods, plywood, composition board.
- (b) Trimmings—Bakelite fittings, compo carvings, transfers.
- (c) Hardware—hinges, locks, and catches of various kinds.

### 2. Hand tool operations:

- (a) More difficult operations, such as sawing tenons and dovetails, boring for dowels, shaping mouldings or band sawn legs, scraping hard woods.
- (b) Jointing, setting and filing rip-saws and crosscut saws; sharpening the more difficult tools, such as scrapers and carving gouges.

### 3. Machine tool operations:

- (a) Variety saw—cutting grooves, dados, tenons, mitres.
- (b) Band saw—sawing curves.
- (c) Drill press—boring operations, cutting mortises, simple shaping and routing.
- (d) Jointer—surfacing, jointing edges, cutting rabbets.
- (e) Lathe—turning matched parts as legs, pairs of candlesticks, turning ornaments, knobs, turning glued-up work.
- (f) Drum and disc sanding operations on the lathe when there is no special machine available.

### 4. Maintenance—the care, adjustment, and fitting of all attachments to the machinery.

### 5. Wood finishing:

- (a) The use and care of finishing materials, particularly of brushes.
- (b) More advanced knowledge of water and oil stains, mixing of fillers, use of shellac, varnish and lacquer.
- (c) More expert treatment of rubbing and polishing, and the refinishing of used furniture.

